Claims

1. Seat of a motor vehicle with a seat back (14) and a seat cushion (1) which is provided with an underspring (2), the springs (3) being arranged substantially in a horizontal plane in or under the seat cushion (1) and are held in each case at their ends on a spring holder (4, 5), characterized in that means (6) for the adjustment of the stiffness of the springs (3) are provided and that each spring (3) has a separate system (6) for adjusting its spring stiffness.

2. Seat according to claim 1, characterized in that each spring (3) has a separate system (6) for adjusting its spring stiffness.

3. Seat according to claim 1 or 2, characterized in that the means (6) for the adjustment of the spring stiffness are configured such that they permit a mechanical shifting of elements substantially in a horizontal plane and in the lengthwise direction of the particular springs (3).

4. Seat according to any one of the foregoing claims, characterized in that a manual, mechanical actuating device (7) is provided for the means (6) for the adjustment of the spring stiffness.

5. Seat according to any one of claims 1 to 3, characterized in that an electronic actuating apparatus (7) is provided for adjusting the spring stiffness as well as a control (8) for the automatic adjustment of spring stiffness for different persons and/or driving situations of the vehicle.

6. Seat according to any one of the foregoing claims, characterized in that the means (6) for the adjustment of the stiffness of the springs (3) are coupled with a sensing means for recording body data of the driver and an adaptive control of the underspring (2) is provided for the automatic adaptation of the stiffness of the springs (3).

7. Seat according to any one of claims 1 to 5, characterized in that the means for the adjustment of the stiffness of the springs (3) are coupled with a control of the motor vehicle for the automatic adaptation of the stiffness of the underspring (2) to different driving situations or driving style.

8. Seat according to any one of the foregoing claims, characterized in that the springs (3) consist of at least two leaf springs (11, 12) joined together, which are loose at one end and fixedly held at the other end, and whose effective spring length is variable by at least one slider (9) which is fastened displaceably on the leaf spring pair.

9. Seat according to any one of claims 1 to 7, characterized in that the springs (3) are meander-shaped wire springs, and that at least one of the spring holders (4, 5) is horizontally displaceable in the direction of the length of the springs.

10. Seat according to claim 9, characterized in that the springs (3) are adjustable mechanically in their stiffness by a spindle provided with the operating device.

11. Springing for a seat of a motor vehicle, having a plurality of mechanical springs (3), the springs (3) being arranged substantially in a horizontal plane with respect to the seat cushion of the seat, and are held in each case at their ends on a spring holder (4, 5), characterized in that means (6) for the adjustment of the stiffness of the springs (3) are provided, and that each spring (3) has a separate system (6) for the adjustment of its stiffness.

12. Springing according to claim 10, characterized in that it is adapted to become integrated subsequently into a seat cushion of a motor vehicle seat.

New Claims

1. Seat of a motor vehicle with a seat back (14) and a seat cushion (1) which is provided with an underspring (2), the springs (3) being arranged substantially in a horizontal plane in or under the seat cushion (1) and are held in each case at their ends on a holding part (4, 5), characterized in that means (6) for the adjustment of the stiffness of the springs (3) are provided and that each spring (3) has a separate system (6) for adjusting its spring stiffness.

2. Seat according to claim 1, characterized in that the means (6) for the adjustment of the spring stiffness are configured such that they permit a mechanical shifting of elements substantially in a horizontal plane and in the longitudinal direction of the particular springs (3).

3. Seat according to claim 1 or 2, characterized in that a manual, mechanical actuating device (7) is provided for the means (6) for the adjustment of the spring stiffness.

4. Seat according to any one of the foregoing claims, characterized in that an electronic actuating apparatus (7) is provided for adjusting the spring stiffness as well as a control (8) for the automatic adjustment of the spring stiffness for different persons and/or driving situations of the vehicle.

5. Seat according to any one of claims 1 to 2 and 4, characterized in that the means (6) for the adjustment of the spring stiffness of the springs (3) are coupled with a sensing means for recording body data of the driver and an adaptive control of the undersspring (2) is provided for the automatic adaptation of the stiffness of the springs (3).

6. Seat according to any one of claims 1 to 4, characterized in that the means for the adjustment of the stiffness of the springs (3) are coupled with a control of the motor vehicle for the automatic adaptation of the stiffness of the underspring (2) to different driving situations or driving style.

7. Seat according to any one of the foregoing claims, characterized in that the springs (3) consist of at least two leaf springs (11, 12) joined together, which are loose at one end and fixedly held at the other end, and whose effective spring length is variable by at least one slider (9) which is fastened displaceably on the leaf spring pair.

8. Seat according to any one of claims 1 to 6, characterized in that the springs (3) are meander-shaped wire springs, and that at least one of the holding parts (4, 5) is horizontally displaceable in the direction of the length of the springs.

9. Seat according to claim 8, characterized in that the springs (3) are adjustable mechanically in their stiffness by a spindle provided with the operating device.

10. Springing for a seat of a motor vehicle, having a plurality of mechanical springs (3), the springs (3) being arranged substantially in a horizontal plane with respect to the seat cushion of the seat, and are held in each case at their ends on a holding part (4, 5), characterized in that means (6) for the adjustment of the stiffness of the springs (3) are provided, and that each spring (3) has a separate system (6) for the adjustment of its stiffness.

11. Springing according to claim 10, characterized in that it is adapted to become integrated subsequently into a seat cushion of a motor vehicle seat.

[This translation begins with the first line of the second paragraph of the page of amendments that is marked as page 2 and continues to the beginning of the last paragraph of the page marked 3. The rest was translated in the main document.]

The document DE 297 23 5865 U discloses a central mechanical adjusting unit in which four meander-shaped springs (Fig. 4) are operated through a central screw mechanism. The operation of the adjusting mechanism is here achieved at the front end of the seat with a turn button projecting forward from the seat.

In contrast, it is the purpose of the present invention to offer a vehicle seat with an underspring for the seat cushion as well as springing of this kind for a seat of a motor vehicle, which is optimally adaptable as regards comfort and seat firmness to different persons and/or driving situations, without requiring structurally complicated devices.

This problem is solved by a seat for a motor vehicle according to the characteristics of claim 1 as well as by springing for a motor vehicle seat according to the characteristics of claim 11. Advantageous configurations and improvements are subject matter of the sub-claims.

The seat for a motor vehicle has – like other known vehicle seats – a seat cushion which is provided with a bottom spring which has a plurality of mechanical springs, the springs being arrayed substantially in a horizontal plane in or under the seat cushion, and mounted at their ends on a spring holder, means being provided for adjusting the spring stiffness. In this way the stiffness of the underspring of the seat cushion can be advantageously varied. Adjustment of the spring stiffness is advantageous on the one hand because the seat can thereby be optimally adapted to different persons of different body structure and body weight, and on the other hand because an adjustment of the spring stiffness can be adapted in each case according to the driving situation or driving style. Due to the possibility of adjusting the spring stiffness of the vehicle's seat, any "bottoming out" of the seat such as happens due to the sagging of the springs after long use, especially in older vehicles, can be effectively prevented. Last, but not least, due to the possibility of adjusting the spring stiffness, a dynamic variation of the seat hardness by periodical replacement or adjustment of the stiffness of one or more springs is possible, as well as the implementation of other orthopedic functions, such as an asymmetrical adjustment of different springs of the underspringing of the seat. An adjustment of the stiffness of the springing of a seat is also advantageous in various driving situations or styles, as for example off-road driving, sport

driving, cornering or driving on bad road surfaces. Also, the comfort of every person is different and, for an optimum in seating comfort, it requires that the stiffness of the car seat be best adapted in each case, since the shock absorption and resonant frequencies of each person are different. The invention thus offers, in a simple design of the seats of vehicles with mechanical springing, an optimum adaptation of the seat stiffness for a definite gain in comfort, in comparison to the vehicle seats known heretofore, which always represent a compromise regarding the hardness or softness of the springing in the seat cushions of vehicle seats.

In one advantageous embodiment of the invention, each spring is provided with a separate device for adjusting its stiffness. In this way a different spring stiffness can be set in different areas of the seat cushion; for example stiffer springing in the middle than in the side areas. Thus the comfort and optimum adjustment of the stiffness of the car seat can be further enhanced, and user-specific stiffness patterns can be produced in a great range of variation. Stiffer springing in the middle of the seat cushion is advantageous, for example, for better support of the spinal region of slipped disk sufferers.

In another advantageous embodiment of the invention, the means for adjusting spring stiffness are constructed such that they permit a mechanical shifting of elements substantially in a horizontal plane and in the direction of the length of the springs of the underspringing of the seat. Thus the means for adjusting spring stiffness require but little space vertically and can be made as flat as possible.

In an additional advantageous embodiment of the invention, a manual, mechanical actuating device is provided for the means for the adjustment of spring stiffness. This has the advantage that the adjustment of the spring stiffness of the vehicle seat can be performed without unwieldy extras and electrical terminals. A mechanical actuating device, such as a pull cable operated by a knob or a lever is also extremely low in cost and not very subject to trouble. According to an alternative embodiment of the invention in this regard, an electronic system of operation is provided, as well as control of the automatic adjustment of spring stiffness for different persons and/or driving situations. Thus the spring stiffness adjustment can be performed automatically for example according to a setting of an automatic operating circuit (normal or sport), or adaptation to different persons and their body sizes or weights.

TRANSLATION OF "NEW PAGE 8" AND REVISED PAGES 9 AND 10, BEGINNING AT MIDDLE OF PAGE "8":

In Figure 1 a part of a motor vehicle is represented schematically, namely the understructure or underspring 2 of the seat cushion 1. This seat has an adjustable seat spring known in the state of the art, the underspring 2 of the seat cushion consisting of a plurality of mechanical springs 3 which, in the embodiment here represented, are three meander-shaped tension springs of wire. The three springs are provided within a frame of the understructure of the seat cushion 1 underneath upholstery (not shown in the figure) and a seat covering. The springs 3 are fastened between two spring holders 4, 5. At least one of the spring holders 4, 5, is displaceable in a horizontal plane lengthwise of the springs 3, so that the stiffness of springs 3 can be adjusted; that is to say, the spring force can be increased or reduced. This is indicated in Figure 1 by the arrows on the front spring holder 4. The displaceability of the spring holder 4, on which one of the ends of the springs 3 is held, can be realized for example by fitting it into lateral grooves or by a threaded spindle mechanism, or by any other means known to the person skilled in the art for the displaceable arrangement of parts. By moving the spring holder 4 leftward the three springs are tensed, so that the spring stiffness is increased in the entire seat surface of the seat cushion. In the opposite direction the stiffness of the springs is reduced.

In Figure 2 a portion of a motor vehicle seat according to a first embodiment of the invention is represented schematically. Here a row of leaf spring bundles arranged side by side is provided as springs 3 of the underspring 2. The underspring 2 consists here of springs 3 and spring bundles which consist each of two leaf springs 11, 12, joined together, which are tightly joined together in the center by a screw 13. Of course, the number and form of the springs in this embodiment are not limitative of the invention, and even four, five or more springs can be provided or another kind of springs, such as leaf springs and tension spiral springs or the like, for example. The spring 3, consisting in each case of an upper 11 and lower 12 leaf spring, is held at their ends in each case on a spring holder 4, 5, as in the former embodiment, one of the spring mounting being fixed (to spring holder 4) and the opposite mounting loose, i.e., able to be moved by sliding (mounting on spring holder 5). On each of the springs two sliders 9 are provided, which are block-like elements which can be slid along the particular spring 3 or spring bundle. The lower leaf spring 12 of each spring bundle is shorter than the upper leaf spring, so that the spring bundle is fastened and mounted only on the upper leaf spring 11. By shifting the sliders 9 toward the center of a spring 3, the

effective spring length, that is, the lever, between the two mounting points of the spring holders 4, 5, are changed. Thus the stiffness of the spring is adjusted, so that by the mere shifting of the sliders 9, for example by an actuating device (not shown in the figure) a change in the stiffness of the underspring of the seat can be made.

In Figure 3 a second embodiment according to the invention of the springing of a seat in a motor vehicle is shown schematically in perspective. In this embodiment conventional wire springs 3 are provided in like manner in the underspring 2 of the seat cushion of the motor vehicle, as well as two adjusting springs consisting of leaf spring bundles 11, 12, as were described in the case of the embodiment of Figure 2. The two leaf spring bundles arranged between the three conventional wire springs with spring holders 9 make possible an adjustment, as described before, of their spring stiffness, by shifting the sliders 9 along the leaf springs 11, 12. The displacement can be performed in this case mechanically by means of an actuating device (not shown in the figure), as for example a Bowden pull mechanism, or else by an electronic or hydraulic operation of the sliders 9.

In Figure 4 a third embodiment according to the invention of a seat of a motor vehicle is represented, coupled to a weight sensing system and to a controller. The driver's seat has a seat cushion and a back rest 14 as well as a underspring 2 for the seat cushion, which is provided in a frame 10 underneath the seat cushion .....